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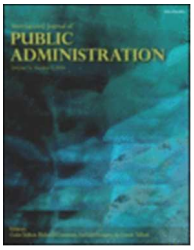

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The public and private sectors are different in terms of ownership, funding and control. The degree of publicness influences the decision-making processes, strategies, and actions, thus severely impacting performance levels. This study contributes to the existing literature on managerial efficiency environmental factors by proposing a framework and methodology for estimating the influence of the *"publicness effect."* **A new method is tested**, relying on the combined integration of three different DEA models in the Italian waste management sector. Results show that the *"publicness effect"* accounts for 33.87% of managerial efficiency for public companies and 11.6% for mixed ones.

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Introduction

The New Public Management reforms introduced a new market approach to public sector management, favouring the externalisation of public services through different governance forms of governance: private corporations, outsourcing, public-private partnerships, and privatisation (Doherty & Horne, 2002; Torres & Pina, 2002; DexiaCrediop, 2004; Reichard, 2007; Keune *et al.*, 2008). In particular, the goal of externalisation is to improve performance in the provision of public services, increase service quality and lower costs. In order to meet these expectations and goals, it becomes critically important for each partner to define which type of governance form should be involved (Broadbent *et al.*, 2003; Rosenau, 2000; Noto & Bianchi, 2015).

The externalisation process led by the recent spending review trends is pushing governments to enhance efficiency while using the best optimization level for resources compared to the public services provided (Levine, 1978; Pandey, 2010). Consequently, the need to deliver and demonstrate value for money in public services will continue to be reinforced (Van Dooren *et al.*, 2010) and well-managed performance measurement systems are critical for accurately and systematically demonstrating operational accountability in governmental organizations (Bianchi & Rivenbark, 2014).

Several scholars have focused their studies on externalisation and on how private sector involvement in public services has led to the creation of new mixed forms of organization, which has made a clear difference in terms of performance. Noticeably, the most common dimension of organizational performance, as highlighted by empirical studies, is efficiency, while the ownership structure (public, private and mixed public-private) of the public service provider offers the governance variable.

In order to add hands-on value to theories, it is necessary to have a deep understanding of public, private, and mixed organizations and to allow for the key characteristics of public services. Some authors find that the differences between the public and private sector, in terms of ownership, funding, and control, are significant and that these differences affect decision processes, strategies, and actions (Nutt, 2000; Boyne 2002), thus influencing the level of performance reached in terms of efficiency.

The purpose of this study is to focus on the governance-performance relationship, highlighting how the public dimension, considered as an environmental factor (identified here as the "*publicness effect"*) has a prominent role in determining the inefficiency of organizational performance. To evaluate the measurement of organizational performance (managerial efficiency), a set of scores for input-specific

efficiency levels has been developed, using the Data Envelopment Analysis (DEA) (Charnes *et al.*, 1978; Fare *et al.*, 1978) non-parametric technique in a modified Slack Based Measure (SBM), (Tone, 2001; 2010) version. This study tested the waste management provision in Italy. It analysed 64 companies that provided waste management services for the year 2010. Public, private, and mixed companies are all players in the waste management sector. Furthermore, as shown by several previous studies (Nutt, 2000; Boyne, 2002), it is reasonable to agree on the fact that variables such as publicness and all the ensuing characteristics in terms of goals, structure, and value, are able to affect the efficiency of the managerial process. In order to neutralize the *"publicness effect"* on the evaluation of efficiency, the "degree of privatisation" variable has been treated as "special input." In this variable, the "*publicness effect"* and degree of privatisation are inversely proportional to each other, or rather, as the public dimension increases, the degree of privatisation diminishes, and vice versa. In DEA jargon the degree of privatisation is seen as non-discretional input, in the sense that it is a factor of production but at the same time is out of the manager's control. It is, to all intents and purposes, an environmental factor. Another way to see it is in terms of an environmental factor influencing performance. By treating the degree of privatisation as non-discretional input, the model makes it possible to estimate efficiency by monitoring it, thus monitoring the "*publicness effect.*" To the best of our knowledge, this is the first application of a non-discretional DEA model for isolating the *"publicness effect"* in the evaluation of efficiency.

The article is organized as follows: the literature review provides the theoretical framework; the second part on data and methodology explains the research methodology and describes data sources along with the details of the construction of variables. Finally, the empirical findings, discussion, and concluding remarks are

presented in results and conclusions.

Literature review

The aim of this section is to define *"performance"* and explain the main theories of governance in order to understand the link between corporate ownership and corporate performance in terms of efficiency. Later, it is demonstrated that the environmental variable (*publicness effect*), as an intrinsic company feature, is able to affect the corporate governance mechanisms and management systems which, in turn, can influence the decision-making activities and, consequently, managerial efficiency. In particular, it is the fact of being public that, due to its characteristics, hampers the managerial operations.

The much-quoted definition of performance coined by Campbell *et al.* (1993) states that *"Performance is what the organization hires one to do, and do well".*

In the literature, a number of authors have conceptualized performance by distinguishing an aspect of action (the quality of action) from an aspect of the outcome (the quality of the achievement) in relation to performance (Campbell, 1990; Campbell *et al*., 1993; Sonnentag & Frese, 2002; Dubnick, 2005; Van Dooren *et al*., 2010). By relying on these two different aspects of performance, Dubnick (2005) differentiates between four perspectives of performance, and defines, among others, performance as productivity or operational efficiency *"the ratio of output to input for a given production unit under given conditions, (i.e. the production function),"* this approach to performance elevates both the quality of the actions as well as the achievements.

As Van Dooren *et al.* (2010) pointed out, outputs and efficiency in the public sector are still inadequate because of the lack of effects in society and because the maximization

of profits is not a primary goal (even if it should be) of the public sector organizations (Bouckaert & Halligan, 2008). Nevertheless, attention to output is equally significant for the public sector in order to evaluate their output mix and to discover whether the supply of public services is accurate (Van Dooren *et al.,* 2010), effective, and efficient. Boyne (2010) argues that public sector organizations are likely to be judged as performing well if their stakeholders believe that they are producing not only the right results (e.g. high scores on performance indicators), but that they are doing this in the right way.

Skelcher (2008), conceptualizing performance in public services and identifying the organizational performance of public service entities, focuses on efficiency, effectiveness, productivity, service quality, and compliance with legal norms. The measurement of the efficiency of public service provision and the identification of optimal operational and business models have become major concerns of policy-makers and scholars. In particular, several scholars have focused their efforts on understanding what influences the typology of ownership and how the corporate governance system may affect efficiency.

Corporate governance focuses on the governance relationship between the shareholder and the company managers. Within this relationship, the interests of the shareholders and managers may vary and these dissimilarities are reflected in decisions, which consequently may have an influence on corporate performance. Corporate governance as a system consists of a set of governance mechanisms managed, where admissible, by shareholders in order to control and direct the managers' behaviour (decisions), thus influencing corporate performance.

Significantly, the governance models indicate that governance-performance causality is

complex (Skelcher, 2008) and performance itself can influence the governance arrangements. The issue of causality is crucial in corporate governance-performance research because without a strong causal link there is no basis for suggesting that governance influences performance, rather than vice versa. Amid the corporate governance literature, there is no consensus on the nature of the causality in the governance-performance relationship (Love, 2010), leaving this issue open for further research. Skelcher (2008) argues the implicit assumption in public services reform initiatives, stating that *"changes to governance arrangements will impact positively on performance outcomes"*.

Several theories (e.g. agency theory, stewardship theory and stakeholder theory) covered insight into the role of governance, whereas others, in determining performance, referred to the ownership structure (public choice theory, property rights theory, transaction cost theory, industrial organization theory).

The *Public Choice Theory* (Tullock, 1965; Niskanen, 1968; Ostrom & Ostrom, 1971; Stretton & Orchard, 1994; Niskanen, 1971; Boyne, 1998; Iovitu & Bran, 2015) suggests a comprehensive understanding of the link between corporate governance, ownership (the *"hard"* governance attributes), and corporate performance (e.g. efficiency), implying that the governance experiences its own agency problems. According to this theory, publicly-owned companies are relatively less efficient than private ones because in publicly-owned companies the managers put their own goals before company efficiency.

Another theory that allows a comprehensive understanding of the link between corporate governance, ownership, and corporate performance is the *Property Rights Theory (*Alchian, 1965; Demsetz, 1967; De Alessi, 1983; Asher *et al.*, 2005).This theory

assumes that ownership leads to greater efficiency within the company. Owners are motivated to perform efficiently because it is in their own best interests to do so. They will aim to retain profits, convert company assets and sell shares in order to gain the greatest possible economic advantage. They are bound to look for the highest level of benefit, and this means increased business efficiency. Indeed, private ownership makes companies relatively more efficient than those owned publicly because their owners will benefit personally from anything that improves company efficiency and profitability.

When compared to the property rights and public choice theories, the transaction cost theory is more aware of the nature of the service, the market and the contracting process. Private companies see an increase in efficiency when transaction costs are low, whilst monopoly markets where transaction costs are relatively high show no difference in efficiency.

Lastly, the industrial organization theory stresses the relevance of the relationship between incentives and ownership that may cause an efficiency discrepancy, under a given market structure, among private and public companies. Hence, and according to Bel *et al.* (2010), private ownership is to be preferred when (1) the owners' time and money devoted to the business provides the necessary information for supervision, (2) firms are exposed to takeover, and (3) they face bankruptcy risks.

With respect to the property rights and public choice theories, it is plausible that private companies outperform public ones. By contrast, the transaction cost and industrial organization theories emphasise the circumstance that the ownership structure impact on corporate performance relies on the nature of the sector that the firms are working in. Furthermore, when transaction costs are relatively higher and in the presence of monopoly markets, it is reasonable that private companies do not outperform public

ones.

Nevertheless, the theoretical perspective outlined herein has led the debate about whether privately-owned companies are more efficient than publicly-owned ones because of the significant and current role of the relationship between governance and performance. Empirical studies indicate that private sector participation in public services has generally improved their efficiency (as suggested by property rights and public choice theory). However, the effects largely depend on the industry (e.g. level of competition, existence of a natural monopoly, size of municipality in terms of inhabitants) and organisational consequences of publicness.

Studies in the waste management sector alongside with their empirical results found evidence supporting the theory that private companies outperformed public ones (Kitchen, 1976; Collins & Downes, 1977; Tickner & McDavid, 1986; Cubbin *et al.*, 1987; Reeves & Barrow, 2000; Moore *et al.*, 2005). Other researchers also indicate an improvement in efficiency after privatisation (Whorthington & Dollary, 2001; Dijkgraaf & Gradus, 2007). Some researchers however show any improvement in overall efficiency (Bosch *et al*., 2001; Sanchez, 2008; Bel & Costas, 2006; Warner, 2012) yet a few others provide information on greater efficiency by public companies. (Dubin & Navarro, 1988; Ohlsson, 2003; Benito *et al.*, 2010). In fact, while the trend is in favour of privatisation, the debate on the influence of ownership is still ongoing and open to contribution. As previously noted, the level of efficiency is influenced by the nature of ownership, ie, it is largely dependent on the organisational consequences of publicness, or rather the environmental factor that **is called** *"publicness effect."*

In fact, there are limitations on the managerial role and constraints are placed by politicians on resources decision and policy boundaries with the exception of companies

that are able to develop and operate in full market conditions, with high revenue levels. The fundamental distinction between public and private organisations lies in their subordination to political power being the private business driven and not politically driven. Public management is also the custodian of factors that are unique to public organisations as well as being very distinct from private management. These unique features envelop the legal framework, such as politician control, the relative open market, and their whose accountability, from different perspectives (not only legal accountability, but also political). Undergoing several public control measures, public organisation is in a different position when considering managerial structures and styles (Horton & Farnham, 1999). In addition, a public organisation sometimes has a close, but weak, connection to other independent public organisations, as their policies can either positively or negatively affect the implementation of its organisational change programmes. (Bianchi, 2010).

Management of a public organisation or private market-driven company is not identical. In fact, managing resources for public services is more customer-driven as it allows managers to lead financial and staff decisions. Business oriented private companies satisfy consumer demand, as a means of making profit, while the public sector tends to satisfy political demand in order to achieve social stability and political integration. with outputs being more quality and effortlessly estimate in the public domain.

As Boyne pointed out (2002), there are some typical variables of public organisations, which are able to influence managerial practices and consequently their efficiency. There is more bureaucracy and red tape, fewer materialistic public managers and weaker organisational commitment.

More bureaucracy: organisations in the public sector follow more formal procedures for

decision-making and are less flexible and more risk-averse than their private sector counterparts (Bozeman & Kingsley, 1998; Farnham & Horton, 1996). These characteristics of public agencies reflect *"the lack of rewards or incentives for successful innovations and the penalties for violation of established procedures"* (Fottler, 1981). Bureaucratic structures may also stem from the requirements of monitoring bodies and demands for accountability in the public sector. As Rainey *et al*. (1976) point out, *"the coercive nature of most government actions might be cited as a fundamental justification for constitutional checks and balances and extensive formal control mechanisms."*

More red tape: this has often been viewed as a pathological bureaucratic side effect (Bozeman & Scott, 1996). The existence of red tape implies an unnecessary and counter-productive obsession with rules rather than results and with processes instead of outcomes. Bozeman *et al*. (1992) argue that *"just as the original annoyance with red tape resulted from the delay caused by untying and tying the tape surrounding (official) documents, red tape today refers not to rules and procedures themselves but to the delays and subsequent irritation caused by formalization and stagnation."*

The beliefs agree on lower *levels of organisational commitment* within the public sector, largely because of the inflexibility of personnel procedures and the weak link between performance and rewards. Perry and Porter (1982) note that *"it is especially difficult for many public agencies to instil employees with a sense of personal significance."* One reason is that it is often difficult for public employees to see any link between their contribution and the success of their organisations. The absence of this link is the result of a variety of factors, including the sheer size of many governments, the pluralistic policy implementation networks, and the lack of clear-cut performance indicators or norms.

This framework led us to the core and aim of research on estimating the influence of the "*publicness effect"* as an environmental factor on managerial efficiency. This, in turn, led us to this research question:

RQ: To what extent is managerial inefficiency in the Italian waste sector due to the "publicness effect?"

Methodology

Sector

The waste management sector is selected in order to assess the "*publicness effect*" on managerial efficiency. The Italian waste management sector is where public, private, and mixed players operate together.

Despite the implementation of the NPM reform of the waste management sector in Italy, most local public services are still managed by public-owned enterprises and, specifically, in 2012, 53% of these kinds of companies were still wholly or largely public owned (Ministero dello Sviluppo Economico, 2015). From a regulatory point of view, the inclusion into the Italian legislative framework of integrated waste management principles issued by the EU relies on legal provisions that date back to 1991. In fact, up to that time the legislator allowed Italian local authorities a form of urban waste management, which provided after the phase of "collection," only the "disposal." Municipal waste has been consider a residual economic activity. In 1997 the Legislative Decree n. 22 (a.k.a "Ronchi Decree") came into force followed in 2006 by the Legislative Decree n. 152 that profoundly changed the national legislation and gave way to the recent amendment of Legislative Decree n. 205 of 2010. At EU level, regulations like the "self-executing" (e.g. import-export waste, "end of waste" etc.)

supports the national framework with direct application rules. The Public Administration provides rules on individual operators' conduct, but its involvement is mainly limited to including clauses in tenders aimed at increasing the technical skills in the prevention of waste generation field (i.e. government's role is to address and overall coordinate the sector). While leading the operational level, local authorities release specific provisions which can cause an extremely atomised, confused and opaque operational framework. Local authorities may also outsource the services to private and mixed companies through tenders and direct awards.

Data and Methodology

This analysis covers 64 Italian companies that provided services for Italian cities in 2010 (it is only one year for which a census was conducted). This database integrates three different sources of data: Ministero dello Sviluppo Economico (2015), AIDA-Bureau Van Dijk (2015) and SOSE (2015). There are 36 public, 23 mixed, and 5 private companies. The efficiency measurement involves choosing the concepts of efficiency, the estimation method and the definition of inputs and outputs. This study applies the Data Envelopment Analysis (DEA) methodology, which is a linear programming technique introduced by Charnes *et al*. (1978), which relies on Farrell's work (1957)[1]. DEA's measure of efficiency reflects whose ability to produce maximum output at minimum cost.

Table 1 (below) shows the descriptive statistics of the sample. It shows the size in terms

[1] The main reason for the use of Efficiency Frontier Techniques like DEA lies in requirement of the smallest number of observations and takes into account simultaneously multiple inputs and outputs, compared to ratios where one input is related to one output each time (Thanassoulis *et al*., 1996).

of inhabitants (population), municipalities where the sample companies operate, degree of privatisation and costs for providing the service.

Table 1. Descriptive Statistics of the Sample (2010).

Table 2 shows the degree of privatisation of the sample. Mixed companies are split into three categories which are: mixed public where the share of participation is irrelevant (under 20%), mixed with level of privatisation between 20 and 45%, and finally the private mixed where the private participation rate - although sometimes not a majority - presumes the *de facto* control of the private counterpart[2].

Table 2. Companies sample as per privatisation rate.

Table 3 outlines the input-outputs variables. The input is the costs of services delivering; the outputs are in terms of physical production.

Table 3. Input - Output Variables (2010).

In order to achieve the intended goal, is assumed (in agreement with existing literature) that the type of ownership influences efficiency (Kitchen, 1976; Collins & Downes, 1977; Tickner & McDavid, 1986; Cubbin *et al.*, 1987; Reeves & Barrow, 2000; Moore *et al.*, 2005). Therefore, in order to estimate efficiency due to management it treats privatisation as an environmental factor to control. The model allows for consistent performance comparison as the comparison is made between firms operating in the same environment (the same rate of privatisation).

From a methodological perspective, the Banker and Morey (1986) approach is followed

[2] subdivision made on the combined basis of specific legal frameworks provide by the Italian Civil Code, Authority specific regulatory provisions for the Italian stock exchange and European directives and regulations relating to high sensitive market sectors.

with a modification of the standard Baker and Morey (1986) model by integrating it with the SBM model put forward by Tone (2010). The result is the combination and integration of the Banker and Morey (1986) and Tone (2001) models, already proposed by Patrizii, Resce (2013), and the SBM introduced by Tone (2010). The advantage of our innovation relies on taking into account the mix inefficiency in addition to the technical one (Farrell, 1957), and at the same time not overestimating the inefficiency as cited by Tone (2010).

DEA literature labels environmental variables as *non-discretional* because they are impossible to be kept under management control. In our model, the *non-discretional* variables are used technically to select the benchmark frontier, but not to estimate inefficiency[3]. Depending on whether the marginal effect on production is respectively good or bad, they are considered non-discretionary output or input in DEA evaluations. In our case study, since following the Sec. Literature review, privatisation has a positive impact on production, but it is not in the discretionary power of management, the share of privatisation is treated a non-discretional input in the evaluation. Therefore, the enucleated integrated approach allows us to take advantage of the SBM as modified by Tone (2010) while treating the non-discretionary inputs as suggested by Banker and Morey (1986).

Like other standard DEA models, our method measures inefficiency as a distance

[3] Banker and Morey method does not pursue to reduce all the inputs but only the sub-vector formed by discretionary inputs; simultaneously it compares each DMU only with those DMUs with an equal or lower value for the corresponding non-discretionary input. It is also important to underline that when referring to researches facing the non-discretionary variables problems, as suggested by Huguenin J.M. (2015) and Harrison *et al*. (2012), since there is no DEA model that is clearly superior in controlling for non-discretionary inputs, the majority of researchers continue to refer to the Banker and Morey (1986) work.

between the firm and the frontier. The peculiarity of our frontier to be the linear combination of the firms using less input, producing more output, and with a rate of privatisation equal or less favourable than the firm under evaluation. The advantage of the SBM method is the opportunity to take each single variable's inefficiency into account while also detecting mix (Tone, 2001) and technical inefficiencies (Farrel, 1957). After making the alteration proposed by Tone (2010), the SBM method measures efficiency by projecting the firm on the nearest point of the frontier. Therefore, the resulting index of efficiency is not underestimated.

Following on from Tone's idea (2010), our algorithm is structured into two stages. In the first, it identifies the frontier by applying a standard SBM as modified in Patrizii, Resce (2013). The linear programme for firm k is[4]:

$$\begin{aligned} \min \rho^{\min} &= t - \frac{1}{m_D}\sum_{i=1}^{m_D}\frac{z_i}{x_{ik}^D} \\ t + \frac{1}{s}\sum_{r=1}^{s}\frac{s_i^+}{y_{ik}} &= 1 \\ ty_k &= \sum_{j=1}^{n} y_j\lambda_j - s^+ \\ tx_k^{ND} &\geq \sum_{j=1}^{n} x_j^{ND}\lambda_j \\ tx_k^D &= \sum_{j=1}^{n} x_j\lambda_j + z \\ t, \boldsymbol{\lambda}, \boldsymbol{s^D}, z &\geq 0 \end{aligned} \qquad (1)$$

It uses: n to indicate the number of firms (64); m_D the number of discretional inputs (1); s the number of outputs (4); $\boldsymbol{y}$ the outputs vector (4×1); $\boldsymbol{x^D}$ the discretionary input scalar; $\boldsymbol{x^{ND}}$ the non-discretionary inputs scalar; $\boldsymbol{z}$ is the input slack times t; $\boldsymbol{s^+}$ is the vector (4×1) of output slack times t. As reported by Patrizii and Resce (2013), the model is peculiar because this evaluation only relies on discretionary variables.

[4]The same linearisation is present in Tone (2001). In (1) all variables are multiplied by t. Although there are just 5 private firms, in (1) it assesses 64 firms, 4 outputs and 1 input, this is well above the minimum firms/variables suggested by Dyson *et al*. (2001).

The third condition regards non-discretionary variables and ensures that the efficiency frontier works with non-discretionary variables equal, or less favourable, to those firms under evaluation. Model (1) allows the reference set (R_k) detection of the k DMU (the reference set is the firms on the frontier):

$$R_k = \{j|\lambda_j^* > 0; j = 1, \dots, n\}$$

It is important to underline that in R_k there are no firms operating with a more favourable environment compared to firm k. The reference set is then used to find the minimum distance from the frontier, i.e. an optimistic measure of efficiency like:

$$\begin{gathered} \max \rho^{\max} = t - \frac{1}{m_D}\sum_{i=1}^{m_D}\frac{z_i}{x_{ik}^D} \\ t + \frac{1}{s}\sum_{r=1}^{s}\frac{s_i^+}{y_{ik}} = 1 \\ t\boldsymbol{y_k} = \sum_{j\in R_k}\boldsymbol{y_j}\lambda_j - \boldsymbol{s}^+ \\ t\boldsymbol{x_k^D} = \sum_{j\in R_k}\boldsymbol{x_j}\lambda_j + \boldsymbol{z} \\ t, \boldsymbol{\lambda}, s^D, z \geq 0 \end{gathered} \qquad (2)$$

With the given level of non-discretionary inputs, the $\rho^{\max}$ index gives a measure of the average reduction of discretionary inputs and a measure of the average increase of outputs necessary to reach efficiency. The $\rho^{\max}$ index in (2) considers constant returns of scale (CRS). It takes both the managerial and scale inefficiency into account. As Banker *et al.* (1984) suggests, in order to define the scale returns, it is necessary to evaluate the value $\sum\lambda$ in (2): if $\sum\lambda < t$, the firm works under increasing returns of scale; if $\sum\lambda = t$, the firm operates under constant returns of scale; if $\sum\lambda > t$ the firm works under decreasing returns of scale. It obtain the index of managerial efficiency by using the variable return to scale (VRS) linear model, which formally adds the convexity condition $\sum\lambda = t$ to the programme (1).

From the results of the CRS and VRS versions, the total inefficiency is break down into

two parts: one depends on management $(1 - \rho^{VRS})$ and the other one caused by the firm dimensions, the scale inefficiency $(\rho^{VRS} - \rho^{CRS})$.

Results

The results obtained from the SBM model efficiency esteem application, as proposed by Tone (2010 version), are shown in the following figures.

Figure 1 shows the measures of technical efficiency, managerial and scale inefficiency organised into five categories of companies and identified by degree of privatisation, obtained by treating privatisation as a control factor. With the same input level, increasing privatisation leads to greater quantity of outputs.

Measuring technical or operational efficiencies is the first essential step for any type of economic evaluation. In fact, it can understand whether the use of resources in the production process performs well or if improvement is possible by eliminating potential squanders.

There is evidence that, in terms of total efficiency, privatisation increases companies' abilities to enhance their performance. Low levels of efficiency are likely to depend on *"bad"* managers' behaviour or incorrect company size (too big or too small) that does not allow them optimal organisation.

Therefore, it calculates scale efficiency and managerial inefficiency in order to make judgment in terms of "economy/diseconomies of scale" and evaluate managerial performance. The inefficiency scale appears to show a positive link to public management. Public companies reach such a size where they began to experience scale diseconomies: further increase in available resources can produce less proportional increase in output; consequently the unit production cost increases. In fact, in terms of

managerial inefficiency (orange rectangle) privatisation seems to unexpectedly have a negative effect on performance. In fact, as Anderson (2000) states, in a natural monopoly, the economies of scale meant firms oriented their trends towards raising production costs more than whatever can be gained from efficiency and competition.

Managerial commitment is varied in each unit because it depends on diverse factors like managers' personalities, environmental pressure, information available, or personal opportunistic reasons, for not providing the best working efforts. That is, all these reasons represent the link to measuring managerial inefficiency. Contrary to expected common beliefs, public managers should provide the best managerial performance.

Figure 1. Efficiency results with the application after having applied of the standard SBM Model.[5]

In order to answer the RQ, the linear models (1) and (2) allow the splits of the managerial efficiency detected with a standard SBM Tone (2010) into discretional and non-discretional. Because the non-discretional input is privatisation, this is named non-discretional *"publicness effect.*" It is the measurement of how managerial inefficiency cannot be put down to a bad manager, but the public sector and all the limitations that it imposes on management. In Figure 2 the total managerial inefficiency showed, in Figure 1 is split into managerial and "*publicness effects."*

As expected, public managers increase performance when the "*publicness effects"* environmental factor is isolated. This effectively allows comparing their operational

[5] Following Färe, Karagiannis (2014) this is an index of efficiency average, weighted for the costs.

work with the management running companies with a higher degree of privatisation.

Mixed-public managers do not show an improvement because they already had the best performance. Performance increases considerably for mixed firms.

Figure 2. The "publicness effect" and managerial inefficiency[6]

However, **this study focuses** on managerial inefficiency by trying to determine how *"guilty"* managers are and whether it depends on real management activities and policies, leadership style, or different types of decision-making processes. In detail, it's founded that the *"publicness effect"* accounts for 33.9% of managerial efficiency for public companies and 11.6% for mixed ones.

Figure 3 shows the optimal scale of production and dimensions. On the ordinate axe in the graph **the inhabitants served are considered**, the black square is the "optimal" size (64,577.71), and the rectangle is the interval between the minimum and maximum city for each category of privatisation.

Figure 3. Return to scale in the Italian waste management sector.

Figure 3 also clearly shows the relationship between privatisation and municipality sizes. In fact, companies show that the more "private" they are (meaning, for the specific case, the trend direction scale oriented from public to private through the mixed) and the closer their size is to the optimal one. This can be interpreted as the

[6] Following Färe, Karagiannis (2014) this is an index of efficiency average, weighted for the costs.

private investor's volition to avoid problems of economy/diseconomy of scale.

In order to add some curiosity and attention to investigation details, the following Figure 4 and 5 highlight the minutia costs of being public, both for public and mixed firms due to the considered variables, where it is possible to point out that the public managers faces with higher costs. On the other hand, when only referring to "expenditures," mixed company managers deal with higher costs.

Figure 4. The details of "publicness effect" (for Public Firms).

Figure 5. The details of "publicness effect" (for Mixed Firms).

Once again the graphs show evidence that those firms facing higher costs are public with obviously public managers having to face greater problems.

Conclusions

In accordance with existing literature, the efficiency analysis has clearly shown that involving the private sector in the ownership of waste service provision - either as stand-alone companies or public sector partners – enhances efficiency in the waste sector. However, not only is the kind of ownership relevant when considering improving efficiency, it is also essential to take several other contextual and environmental factors into account. The study highlighted that as an environmental factor "*publicness effect"* significantly impacts on the level of managerial efficiency. In fact, it accounts for 33.9% of managerial efficiency for public companies and 11.6% for mixed ones. Scholars that investigate organisational performance have always

concentrated on investigating managers' aptitude to dealing with resources that they are able to control, without taking environmental factors into account. These factors cannot be controlled, but heavily impact the performance level reached.

Managers of public-sector entities must take a multiplicity of stakeholders with heterogeneous needs and features into consideration, all of which could potentially influence their decision-making processes. Strategies and actions are also significantly constrained, shaped and affected by political orientation, rhythms and incentives. So the "*publicness effect"* represents an intrinsic component of a company and an environmental effect that managers can't control although they can influence managerial decisions and consequently the company's performance in terms of efficiency.

This study has shown that "*publicness effect*" is able to influence the efficiency measurement. For the first time, **is isolated** the "*publicness effect*" and proposed itself as a reference framework for assessing managerial activities.

This framework is based on the fact that unveiling the effects of being a Public company on the efficiency level is arguably a difficult exercise because of the being public is not only a simple choice and many public companies, for many and different reason as for many other external factors, will never become mixed or private.

Evidence also indicates that economies of scale are a relevant economical factor. In fact, this study provides findings on the fact that many waste service operators, mostly public and mixed owned companies, should reduce their operational size in order to increase their operational efficiency. The unexpected result of this empirical study shows that the managerial inefficiency level - contrary to what one might expect and according to existing literature - is higher in private companies than in public owned ones.

In addition, the waste management sector is a *de facto* service performed in a market of a natural monopolistic nature (therefore, not truly competitive), private companies apparently and *prima facie* appear to achieve better performance which means that private companies are able to show a size close to the optimal one. On the other hand, the municipal waste collection service is actually exemplified by the presence of public companies when referring to a greater number of city inhabitants.

Likewise, the research findings suggest that the rate of privatisation increases a company's abilities to enhance its performance and that Public companies are paying a higher price due to their being public. That is, Public firms appear to face these kinds of costs while trying to meet multiple purposes and achieve a strategic balance by integrating public and commercial values. Given these results, it is possible to argue that public and mixed are not equivalent while privates apparently perform better. At the same time, however, they avoid multifaceted problems that can be caused by large cities as, from a managerial perspective, also by the *"ball and chain"* of being a public organisation.

Lastly, the positive expectations effects from privatisation like gains in efficiency, users' price reductions, quality services improvement, investments increase for maintenance, modernisation of systems and structures, are not always fully accomplished or are only partially. The positive effects are often real and perceptible in the short term and in some cases, were then downsized or invalidated in the medium to long term by market dynamics that led to the creation of private monopolies that are able to avoid elude actions in order to protect competition (Borgonovi, 2007).

From our point of view, the results of this study, in order to achieve sound judgement about the benefits of every kind of corporate governance, adds significant and useful

information for managers and policy-maker. It also highlights the necessity, when investigating the efficiency of companies characterised by a different ownership structure, to consider the environmental variables that are able to influence the managerial efficiency measure. By isolating these factors, this paper proposes a framework and reference method, which **is applied** here on the incidence of the public dimension. It refers to the Italian waste sector, but is possible to reply and apply to other sectors. In fact, this is a useful and replicable model for the operations evaluation of management.

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The impact of environmental factors on the measurement of managerial efficiency in the Italian waste management sector. Framework and empirical evidence.

Table 1, Descriptive Statistics of the Sample (2010).

	Min.	Max	Average
Population (000)	28 (Mogliano Veneto)	2.761 (Rome)	167
Rate of privatisation	0 (36 Municipalities)	100 (5 Municipalities)	23
Costs (000)	356 (Schio)	630000 (Rome)	32059

Sources: Ministero dello Sviluppo Economico (2015); AIDA-Bureau Van Dijk (2015); SOSE (2015)

Table 2. Companies sample as for the privatisation rate.

	Rate of privatisation	N.
Public	0%	36
Mixed – Public	0% - 20%	2
Mixed	20% - 45%	11
Mixed - Private	45% – 55%	10
Private	100%	5

Source: authors' elaboration from AIDA-Bureau Van Dijk (2015) data

Table 3. Input - Output Variables (2010).

		Average	Median	Std. Dev.
Costs (000)	Input	32.059	9.688	87.202
Manholes Cleaned	Output	15.350,58	4.368,00	133,61
Deratting Interventions	Output	235,13	4.609,00	133,68
Tons of Separate Waste Collected	Output	34.195,75	4.368,00	132,68
Tons of Total Waste Collected	Output	101.644,98	4.273,50	131,58

Source: authors' elaboration from SOSE (2015) data

Figure 1. Efficiency results with the application after having applied of the standard SBM Model.

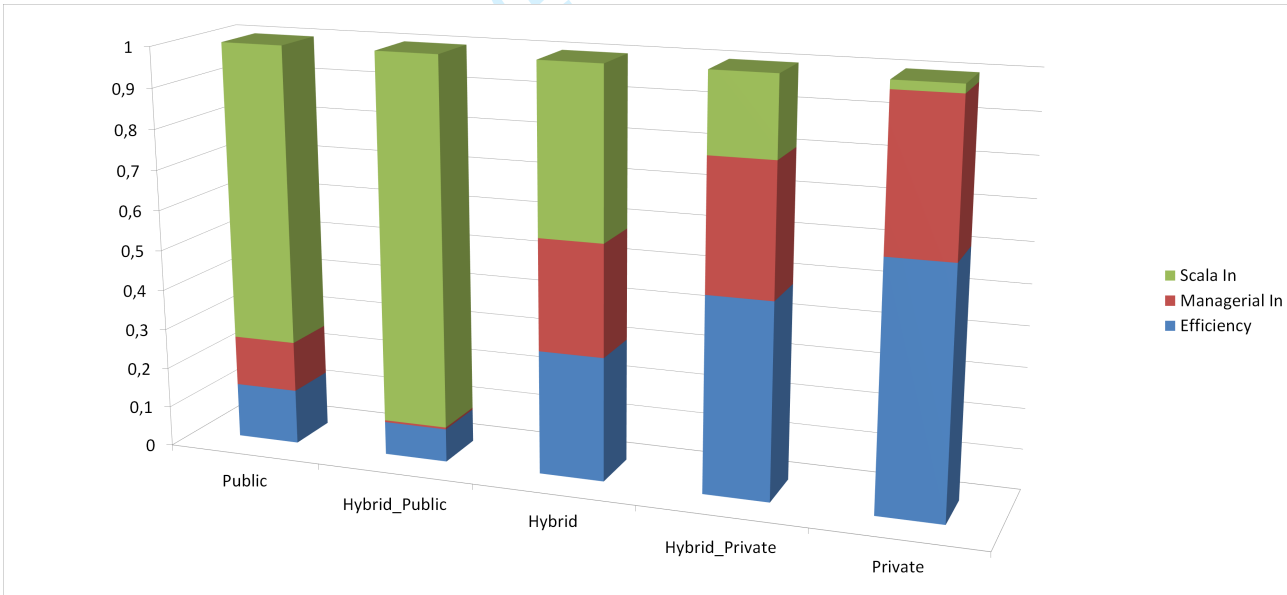

Figure 2. The "publicness effect" and the managerial inefficiency

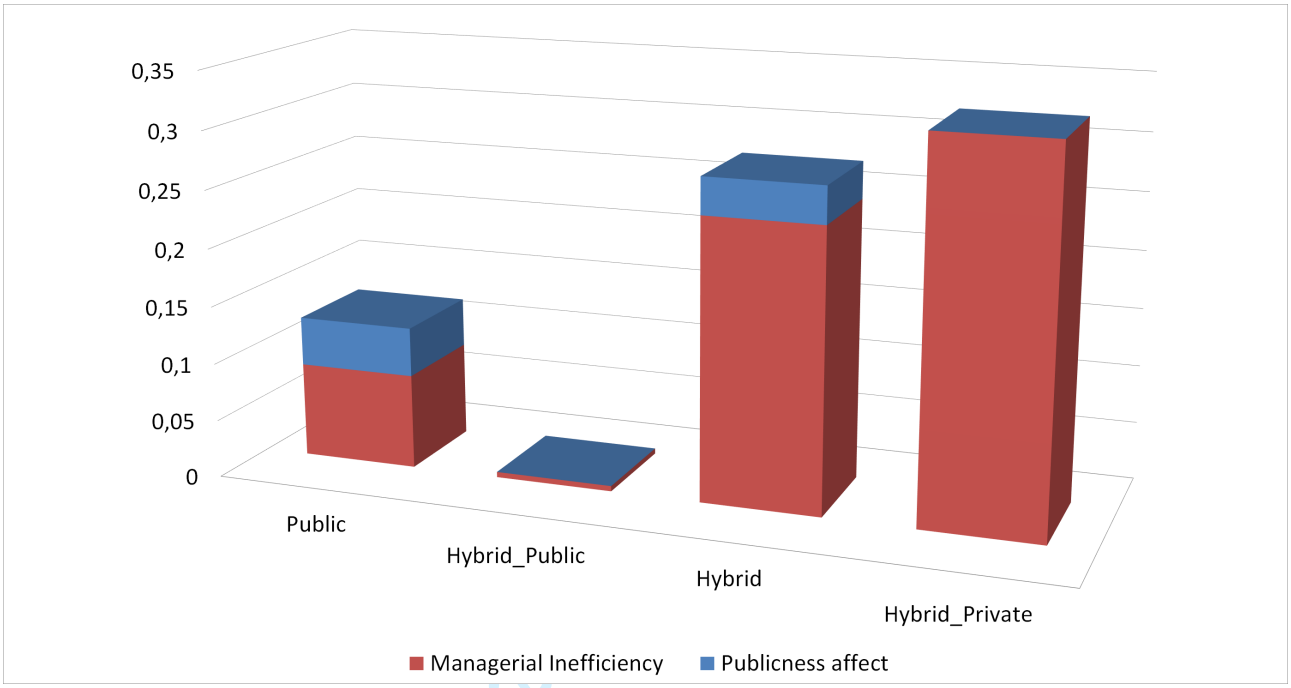

Figure 3. Return to scale in the Italian waste management sector.

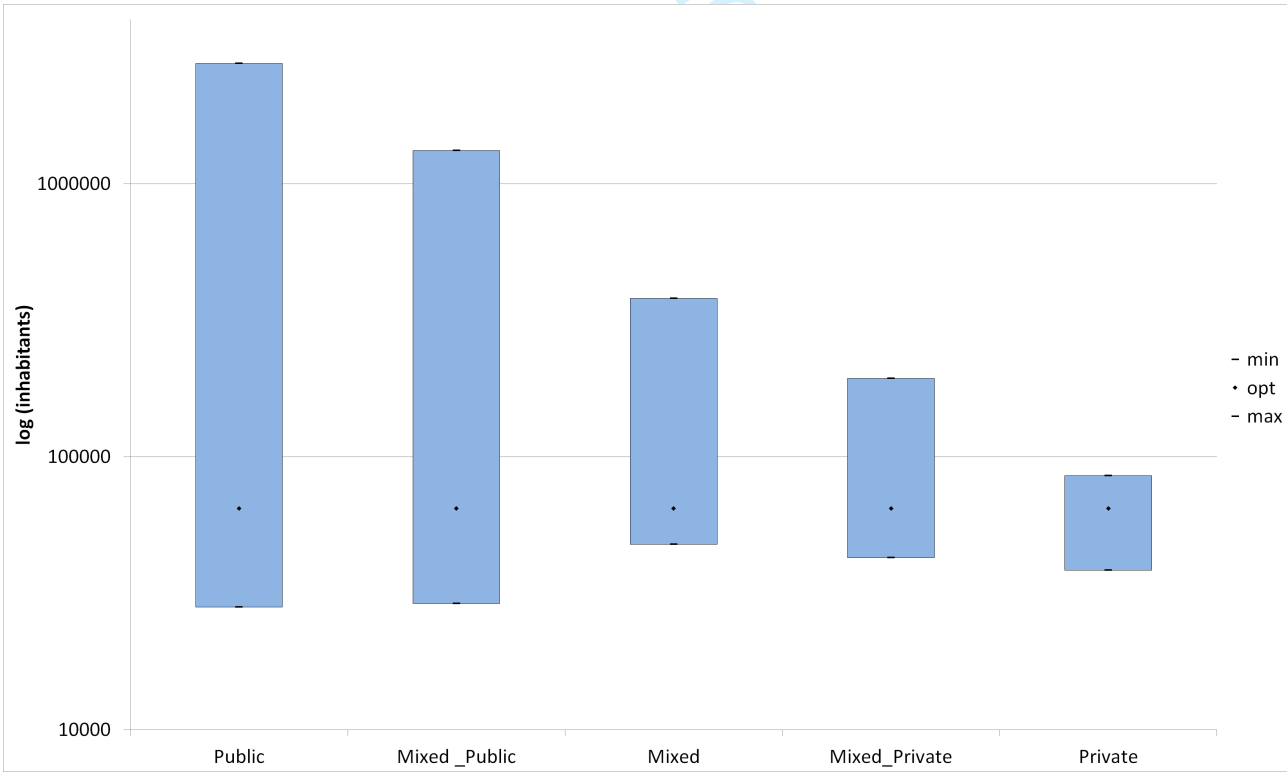

Figure 4. The details of "publicness effect" (for the Public Firms).

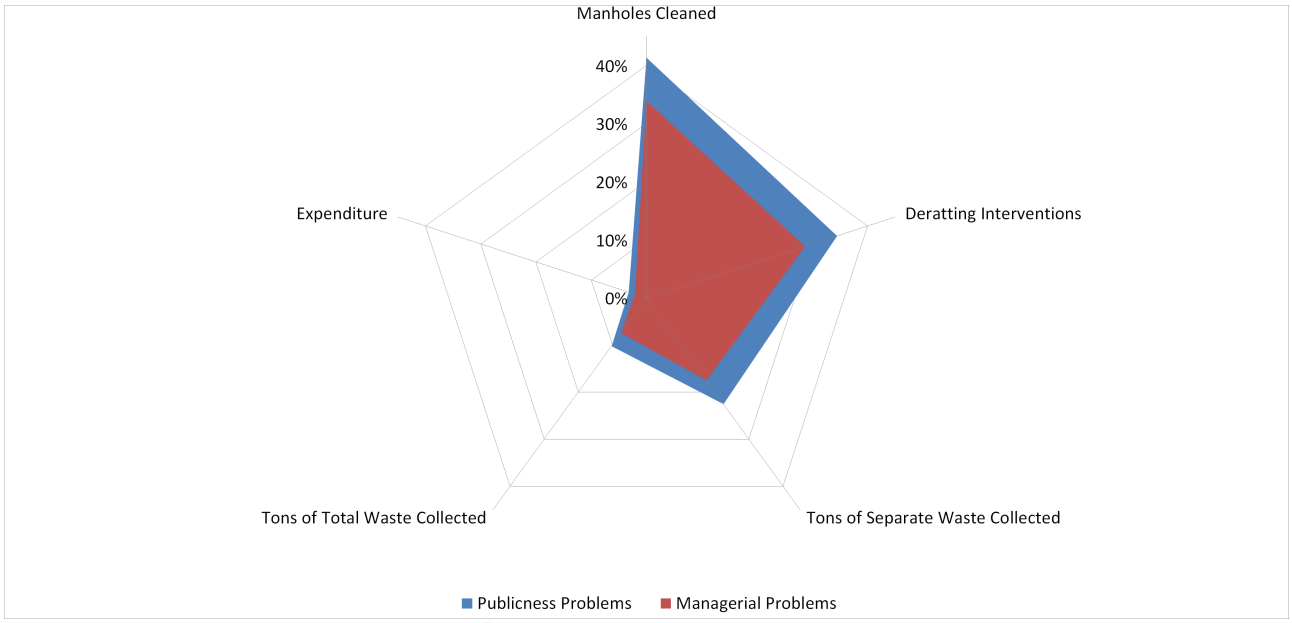

Figure 5. The details of "publicness effect" (for the Mixed Firms).